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EXAMINER

DASTOURI, MEHRDAD

ART UNIT

PAPER NUMBER

2623

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12

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/249,728

Applicant(s)

LOPEZ ET AL.

Examiner

Mehrdad Dastouri

Art Unit

2623

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 April 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-22 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Applicants' amendment filed April 1, 2003, has been entered and made of record.
2. Applicants' arguments have been fully considered but they are not persuasive.

Applicants argue in essence that prior art of record (Mansfield et al) do not obtain and process digital image data.

The Examiner disagrees and indicates that **"digital image data" merely represent the binary data associated with the values of the image pixels (represented by a n-bit byte) that are readable by the image processing computers.** The digital image data (contrary to analog image data) is the digital image pixel data that can be addressed individually and is readable by a computer. Mansfield et al undoubtedly obtain and process digital image data corresponding to an image of a reticle (Abstract, Lines 6-9. The analysis of undesirable feature on photomask is performed on lithographic images (i.e., digital image data) that represent the image that is transferred onto the semiconductor wafer by the lithography process; Column 2, Lines 13-15; Column 8, Lines 54-67, Column 9, Lines 1-4. The AIMS (Aerial Image Measurement System) records the aerial image of the photomask that is projected onto the photoresist by the lithography exposure tool.

It is further emphasized that AIMS obtains and processes aerial image (a narrower version of digital image data) recited in dependent Claim 4.

Regarding Applicants further argument concerning identifying defects, Applicants are respectfully referred to the teachings of Mansfield in Column 6, Lines 44-53. It is

evident that a reticle defect could not be classified as significant prior to identifying the defect.

Regarding Applicants' arguments that Neary performs simulation optically not by processing digital image data, it is once more emphasized that digital image data is a broad limitation that refers to the that could be data processed by computer due to the digitized nature of the data (not analog). Claim language does not exclude processing of the digitized optical data by a computer.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

4. Claims 1-13, 16, 17 and 19 are rejected under 35 U.S.C. 102(e) as being anticipated by Mansfield et al (U.S. 5,965,306).

Regarding Claim 1, Mansfield et al disclose a method for detecting defects in a reticle used in integrated circuit chip fabrication comprising:

(a) obtaining digital image data corresponding to an image of a reticle (Abstract, Lines 6-9; Column 2, Lines 1-15; Column 5, Lines 7-12; Column 8, Lines 54-67, Column 9, Lines 1-4);

(b) processing the digital image data according to predetermined criteria to identify defects (Figures 2-4; Column 6, Lines 62-67; Column 7, Lines 1-8; Column 8, Lines 54-67, Column 9, Lines 1-4);

(c) simulating a response that would be produced if a defective reticle were to be utilized in a photolithographic system, by processing the digital image data corresponding to the reticle (Column 4, Lines 66-67, Column 5, Lines 1-12; Column 7, Lines 41-50; Column 8, Lines 54-67, Column 9, Lines 1-20).

Regarding Claim 2, Mansfield et al further disclose a method according to Claim 1, wherein the digital image data are obtained by scanning the reticle (Column 2, Lines 1-15. Scanning the reticle is an inherent process of Aerial Image Measurement System (AIMS)).

Regarding Claim 3, Mansfield et al further disclose a method according to Claim 1, wherein the defects are identified in step (b) by comparing the digital image data to reference image data (Column 4, Lines 30-41; Column 6, Lines 62-67, Column 7, Lines 1-8).

Regarding Claim 4, Mansfield et al further disclose a method according to Claim 1, wherein step (c) simulated an aerial image, which would be produced by the reticle (Column 2, Lines 7-15; Column 7, Lines 41-46; Column 8, Lines 54-67, Column 9, Lines 1-4).

Regarding Claim 5, Mansfield et al disclose a method according to Claim 1, further comprising a step of categorizing defects based on simulation results produced in step (c) (Column 7, Lines 41-46; Column 9, Lines 13-21. Based on the mask critical

dimension (CD) errors, the defects are categorized to verify whether it is necessary to be repaired or not. This will determine if an undesirable feature on a mask (reticle) is a critical defect or not.).

Regarding Claim 6, Mansfield et al further disclose a method according to Claim 1, wherein the digital image data are in raster format (Column 2, Lines 1-15. Aerial Image Measurement System (AIMS) inherently generate digital images of lithographic mask. A digital image is inherently in a raster format containing rectangular array of pixels that can be addressed individually.).

Regarding Claim 7, Mansfield et al further disclose a method according to Claim 1, further comprising a step of modifying a format of the digital image prior to performing step (c) (Column 10, Lines 4-33).

Regarding Claim 8, Mansfield et al further disclose a method according to Claim 1, further comprising a step of providing a reference simulation for comparison to a simulation produced in step (c) (Column 2, Lines 1-15; Column 5, Lines 3-12; Column 7, Lines 41-50).

With regards to Claim 9, arguments analogous to those presented for Steps (a), (b) and (c) of Claim 1 are applicable to Steps (a), (b) and (d) of Claim 9. Regarding Step (c) of Claim 9, Mansfield et al further disclose specifying a window around one of the defects identified in Step (b) (Column 1, Lines 57-67).

With regards to Claim 10, arguments analogous to those presented for Claim 2 are applicable to Claim 10.

With regards to Claim 11, arguments analogous to those presented for Claim 4 are applicable to Claim 11.

With regards to Claim 12, arguments analogous to those presented for Claim 5 are applicable to Claim 12.

With regards to Claim 13, arguments analogous to those presented for Claim 8 are applicable to Claim 13.

With regards to Claim 16, arguments analogous to those presented for Claim 3 are applicable to Claim 16.

With regards to Claim 17, arguments analogous to those presented for Claim 1 are applicable to Claim 17.

With regards to Claim 19, arguments analogous to those presented for Claim 9 are applicable to Claim 19.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 14, 15, 18 and 20-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mansfield et al (U.S. 5,965,306) in view of Aloni et al (U.S. 5,619,429).

Regarding Claim 14, Mansfield et al do not specifically disclose a method according to Claim 9, wherein the window is 64 x 64 pixels. Selection of window size is

an engineering design choice and is based on the specific requirements of the particular process which is normally is a block of 16 x 16, 32 x 32 or 64 x 64 pixels (Official notice).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify Mansfield et al invention to specify a window of 64 x 64 pixels because it is one of the most common size of the windows routinely implemented in image processing.

Regarding Claim 15, Mansfield et al do not explicitly disclose a method according to Claim 9, wherein the digital image data processed in step (d) are grayscale data.

Aloni et al disclose an inspection method for identifying integrated circuit defects, wherein the target and reference image digital data are grayscale data (Column 9, Lines 40-42).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify Mansfield et al invention according to the teachings of Aloni et al to process a digital image data comprising grayscale data because it is the conventional procedure in processing the digital image data routinely implemented in digital image processing. In digital images, each pixel value (intensity) is associated with a grayscale range, which is a function of the number of bits of the byte representing pixel value (e.g., 0-255 for an eight-bit pixel).

With regards to Claim 21, arguments analogous to those presented for Claim 1 are applicable to Claim 21. Mansfield et al don not explicitly disclose the components of the simulation processor.

Aloni et al disclose a processor for executing stored program instruction; and a memory connected to processor for storing the program instructions steps (Figure 1/ 2 and 13, Processor 67. Memories for storing the program instruction steps are inherently a part of and necessarily connected to the processor.).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify Mansfield et al invention according to the teachings of Aloni et al to explicitly identify components of the processing system because computer-based processing systems conventionally include a processor for executing stored program instruction and a memory connected to processor for storing the program instructions steps.

With regards to Claims 18 and 20, arguments analogous to those presented for Claim 21 are applicable to Claims 18 and 20.

With regards to Claims 22, arguments analogous to those presented for Claims 9 and 21 are applicable to Claim 22.

7. Claims 1-4, 6-11, 13-17, 19, 21 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aloni et al (U.S. 5,619,429) in view of Neary et al (U.S. 6,016,357).

Regarding Claim 1, Aloni et al disclose a method for detecting defects in a reticle used in integrated circuit chip fabrication comprising:

(a) obtaining digital image data corresponding to an image of a reticle (Column 2, Lines 34-37; Column 9, Lines 40-42);

(b) processing the digital image data according to predetermined criteria to identify defects (Column 10, Lines 8-41). Aloni et al do not disclose Step (c) concerning simulating a response that would be produced if the defective reticle were to be utilized in a photolithographic system, by processing the digital image data corresponding to the reticle. Simulation is a well known procedure for modeling manufacturing products as taught by Neary et al. Neary et al disclose a method of repairing a mask for use in lithographic manufacturing of semiconductors comprising the step of:

(c) simulating a response that would be produced if a defective reticle were to be utilized in a photolithographic system, by processing the digital image data corresponding to the reticle (Figure 2, defect 24; Figures 10 and 16; Column 6, Lines 25-67, Column 7, Lines 1-4, particularly Column 6, Lines 59-65. Simulation is performed by obtaining aerial images of the defected mask (reticle) and comparing the aerial image of the defected mask with the aerial image of the ideal mask. Simulation results indicate the defect deviations 78a and 78b as depicted in Figures 16 and 17.).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify Aloni et al invention in accordance with the teachings of Neary et al to simulate a response that would be produced if the defective reticle were to be utilized in a photolithographic system, by processing the digital image data corresponding to the reticle because it will provide necessary corrective steps to modify the defective reticle and prevent mass production of the defected masks or reticles.

Regarding Claim 2, Aloni et al further disclose a method according to Claim 1, wherein the digital image data are obtained by scanning the reticle (Column 9, Lines 40-42).

Regarding Claim 3, Aloni et al further disclose a method according to Claim 1, wherein the defects are identified in step (b) by comparing the digital image data to reference image data (Column 10, Lines 26-29).

Regarding Claim 4, Neary et al further disclose a method according to Claim 1, wherein step (c) simulated an aerial image, which would be produced by the reticle (Column 6, Lines 59-65).

Regarding Claim 6, Aloni et al further disclose a method according to Claim 1, wherein the digital image data are in raster format (Column 9, Lines 40-42. A digital image is inherently in a raster format containing rectangular array of pixels that can be addressed individually.).

Regarding Claim 7, Neary et al further disclose a method according to Claim 1, further comprising a step of modifying a format of the digital image prior to performing step (c) (Figure 3; Column 4, Lines 28-37).

Regarding Claim 8, Neary et al further disclose a method according to Claim 1, further comprising a step of providing a reference simulation for comparison to a simulation produced in step (c) (Figure 10, Step 46; Column 6, Lines 35-45).

With regards to Claim 9, arguments analogous to those presented for Steps (a), (b) and (c) of Claim 1 are applicable to Steps (a), (b) and (d) of Claim 9. Regarding Step (c) of Claim 9, Aloni et al further disclose specifying a window around one of the

defects identified in Step (b) (Figure 12, Moving Window 228; Column 25, Lines 63-67, Column 26, Lines 1-22).

With regards to Claim 10, arguments analogous to those presented for Claim 2 are applicable to Claim 10.

With regards to Claim 11, arguments analogous to those presented for Claim 4 are applicable to Claim 11.

With regards to Claim 13, arguments analogous to those presented for Claim 8 are applicable to Claim 13.

Regarding Claim 14, Aloni et al do not specifically disclose a method according to Claim 9, wherein the window is 64 x 64 pixels. The windows specified by Aloni are 32 x 24 pixels. Selection of window size is a designer choice. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify Aloni et al and Neary et al combination to specify a window of 64 x 64 pixels because it is one of the most common size of the windows routinely implemented in image processing.

Regarding Claim 15, Aloni et al further disclose a method according to Claim 9, wherein the digital image data processed in step (d) are grayscale data (Column 9, Lines 40-42).

With regards to Claim 16, arguments analogous to those presented for Claim 3 are applicable to Claim 16.

With regards to Claims 17 and 21, arguments analogous to those presented for Claim 1 are applicable to Claims 17 and 21. Regarding Claim 21, Aloni et al further

disclose a processor for executing stored program instruction; and a memory connected to processor for storing the program instructions steps (Figure 1/ 2 and 13, Processor 67. Memories for storing the program instruction steps are inherently a part of and necessarily connected to the processor.).

With regards to Claims 19 and 22, arguments analogous to those presented for Claim 9 are applicable to Claims 19 and 22. Regarding Claim 22, Aloni et al further disclose a processor for executing stored program instruction; and a memory connected to processor for storing the program instructions steps (Figure 1/ 2 and 13, Processor 67. Memories for storing the program instruction steps are inherently a part of and necessarily connected to the processor.).

8. Claims 5 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aloni et al (U.S. 5,619,429) further in view of Neary et al (U.S. 6,016,357) and Mansfield et al (U.S. 5,965,306).

Regarding Claim 5, neither Aloni et al nor Neary et al explicitly disclose a method according to Claim 1, further comprising a step of categorizing defects based on simulation results produced in step (c). Mansfield et al disclose a method of determining the printability of photomasks defects comprising a step of categorizing defects based on the simulation results (Column 7, Lines 41-46; Column 9, Lines 13-21. Based on the mask critical dimension (CD) errors, the defects are categorized to verify whether it is necessary to be repaired or not. This will determine if an undesirable feature on a mask (reticle) is a critical defect or not.). It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify Aloni et al

and Neary et al combination according to the teachings of Mansfield et al to categorize the defects based on simulation results produced in step (c) because it will limit the repairs of the defective reticles to those which will adversely affect the performance of the semiconductor integrated circuit.

With regards to Claim 12, arguments analogous to those presented for Claim 5 are applicable to Claim 12.

9. Claims 18 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aloni et al (U.S. 5,619,429) further in view of Neary et al (U.S. 6,016,357) and Medvedeva et al (U.S. 6,171,731).

Regarding Claim 18, neither Aloni et al nor Neary et al explicitly disclose a computer readable medium according to Claim 17, comprising at least one of a magnetic diskette, magnetic tape, a CD-ROM, a random access memory chip, and a read-only computer memory chip. The indicated memories are the conventional types of memories as disclosed by Medvedeva et al. Medvedeva et al disclose an aerial image simulation system for the aerial images produced by a mask to be used in patterning an integrated circuit chip including a computer readable medium comprising at least one of a magnetic diskette, magnetic tape, a CD-ROM, a random access memory chip, and a read-only computer memory chip (Figure 10; Column 19, Lines 4-13). It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify Aloni et al and Neary et al combination according to the teachings of Medvedeva et al to include a computer readable medium comprising at least one of a magnetic diskette, magnetic tape, a CD-ROM, a random access memory

chip, and a read-only computer memory chip because these are the conventional types of memory routinely utilized in the art.

With regards to Claim 20, arguments analogous to those presented for Claim 18 are applicable to Claim 20.

Conclusion

10. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Contact Information

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mehrdad Dastouri whose telephone number is (703) 305-2438. The examiner can normally be reached on Monday to Friday from 8:00 a.m. to 4:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au can be reached on (703) 308-6604.

Art Unit: 2623

The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9314 for regular communications and for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the T.C. Customer Service Office whose telephone number is (703) 306-0377.



Mehrdad Dastouri
Primary Examiner
Group Art Unit 2623
June 12, 2003